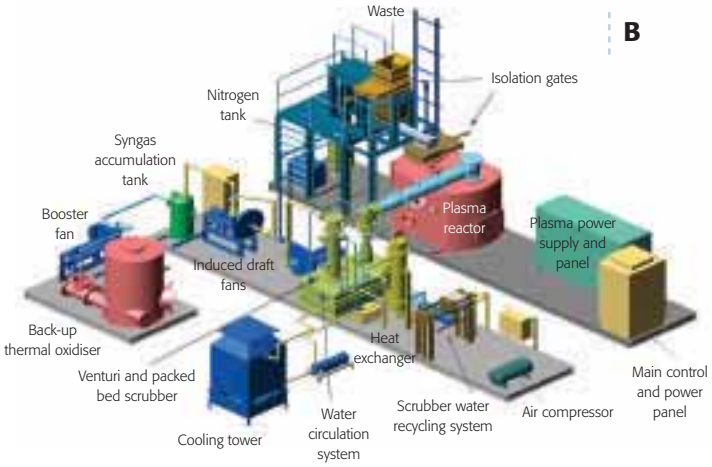
Back to Base

Figure 1: Example of a PTDR system A

By Daniel Ripes at PEAT International

New regulations present opportunities for manufacturers and distributors to process pharmaceutical waste on-site, and may even become mandatory in some areas in the future. But how can these potential collectors profit from take-back programmes?



The biggest beneficiaries of two new pharmaceutical waste regulations – enacted in the US in late 2014 – may ultimately be logistics companies and compact thermal treatment technologies.

Keywords

Take-back/mail-back programmes
On-site disposal
Thermal treatment
Compact plasma arc gasification

In October 2014, the US Drug Enforcement Agency re-classified hydrocodone from schedule three to schedule two within the hierarchy of the Controlled Substances Act. Essentially, this means more paperwork, oversight and costs as it relates to tracking, transport and eventual disposal.

Take-Back Programmes

The other new, and likely more impactful, regulation published in September 2014 allows pharmacies, hospitals, long-term care facilities and other authorised entities to collect unused medications from the public. This means manufacturers, distributors and/or reverse distributors can now become collectors using various receptacles, take-back events or mail-back programmes, as long as they have an on-site means of destruction for the returned packages. The key phrase here is 'on-site', as nearly all of these potential collectors generally lack any kind of on-site treatment system.

Besides hydrocodone-based drugs, these take-back programmes could encompass other drugs such as OxyContin, Percocet, Adderall and Ritalin, as well as drugs like Vicodin and Tylenol with Codeine – all of which must be processed by incineration or an approved thermal treatment process.

Permission for new centralised thermal treatment systems is controlled at a local level and, as such, the appetite to site and install incinerators is low – largely because of a pervading 'not-in-my-backyard' attitude. This means that potential collectors may have a fight on their

hands to find an on-site solution using traditional means.

Ultimately, if manufacturers, distributors and/or reverse distributors want to become competitive players in the future of pharmaceutical waste processing, then alternative options are necessary.

New Approach

Compact plasma arc gasification systems aim to address this need. One example is Plasma Thermal Destruction and Recovery (PTDR) technology, which has been approved by the California Department of Public Health as a substitute to incineration. It offers a single-stage total waste destruction system using plasma arc gasification that can manage pharmaceutical waste, including any take-back product.

The patented PTDR technology superheats an oxygen-starved reactor using a plasma arc (sometimes referred to as the fourth stage of matter) to transform the organic components of waste into an alternative to natural gas, or 'syngas'. The plasma arc, which converts electrical energy into thermal energy, creates an ultra-high energy environment that breaks up the molecules in the waste.

The syngas consists mainly of carbon monoxide and hydrogen, and after it leaves the reactor, it is polished and processed in a gas-cleaning subsystem where it can then be beneficially used or emitted into the atmosphere. Table 1 compares air emissions from a PTDR system against small municipal waste combustor (SMWC) standards. SMWCs are approved by the US Environmental Protection Agency (EPA) for the destruction of take-back products.

The 'inorganic' volume in waste feedstock becomes a solid, recoverable end-product in the form of a usable, vitrified glass matrix, which can prove suitable for various industrial and construction applications. No secondary solid waste is produced to require further treatment, and significant volume and physical weight reductions can be achieved.

Case Study

A PTDR system located in Sacramento, US, has already processed a variety of waste stream types, including pharmaceutical waste supplied through the Sacramento County's voluntary take-back programme. At under 250m^2, the physical footprint for this system supports an on-site installation (see Figure 1).

The PTDR's process control system allows a single trained employee to operate the entire system; however, additional personnel may be required depending on the specific material handling needs. This control system monitors all input and output parameters and prompts the operator to make appropriate alterations – or alternatively, it can make automatic adjustments to ensure that the system's operation meets prescribed environmental standards.

Pre-processing or staging costs of the waste material are minimised or eliminated as the system is designed to process a wide variety of feedstocks, and the sole heat source is the plasma arc. This design feature allows for the treatment of both organic and inorganic feedstocks, as well as resulting in waste with little or no calorific value.

In addition to labour, the PTDR system consumes electricity, water, nitrogen, plasma electrodes and sodium hydroxide during operations. Using basic consumables ultimately minimises the operational expenses for the system – for example, it costs approximately $0.80 per kg to destroy pharmaceutical waste when operating at 60kg per hour.

Table 1: Air emissions comparison between a PTDR system and SMWC standards

Parameter (USEPA 23)	US EPA 40 CFR part 60 subpart AAAA	PTDR operating at 125kg/hour (corrected to 7% oxygen as per US EPA standards)	PTDR operating at 60kg/hour (corrected to 7% oxygen as per US EPA standards)
HCl	25ppmv	Not detectable (detectable limit 5.1ppmv)	Not detectable (detectable limit 1.5mg/m^3)
Pb	0.020mg/dscm	0.0061	Not detectable (detectable limit 1µg/m^3)
Cd	0.020mg/dscm	0.0027	0.02488
Hg	0.080mg/dscm	0.0089	Not detectable (detectable limit 1µg/m^3)
Particulate matter	24mg/dscm	11.24	30.86
Dioxins and furans	13ng/dscm	0.034ng toxic equivalency factors	0.057ng toxic equivalency factors
NOx	500ppmv	33.73	80.26
SO2	30ppmv	21.77	10.14
CO	50ppmv	Not detectable (detectable limit 2.8ppmv)	N/A

Emerging Trend

Voluntary mail-back and take-back programmes are becoming more common throughout the US. However, many of these could become mandatory for manufacturers to support, depending on how an emerging take-back programme in Alameda Country, California evolves. This programme would require drug manufacturers and producers that sell certain prescription drugs in the county to collect and dispose of unwanted pharmaceuticals from local residents.

If more of these types of programmes become mandatory, the opportunity for forward-thinking manufacturers, distributors and reverse distributors to establish on-site treatment capabilities could prove immense. On-site plasma arc gasification systems may be the industry solution to capitalising on this growing potential.

Daniel Ripes is the Corporate Finance Manager and a Business Development Executive at PEAT International. He holds a Master of Business Administration from the Liautaud School of Business at the University of Illinois at Chicago, and a Bachelor of Arts in Communications from the University of Illinois, Urbana-Champaign. Email: dripes@peat.com